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(54) **WELLHEAD SYSTEM FOR TIEBACK RETRIEVAL**

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E21B 33/03 (2006.01)
E21B 33/04 (2006.01)
E21B 33/068 (2006.01)
E21B 43/26 (2006.01)

(52) **U.S. Cl.**
CPC ***E21B 33/03*** (2013.01); ***E21B 33/04*** (2013.01); ***E21B 33/068*** (2013.01); ***E21B 43/26*** (2013.01)

(58) **Field of Classification Search**
CPC E21B 33/03; E21B 33/04; E21B 33/047; E21B 33/068; E21B 43/26
See application file for complete search history.

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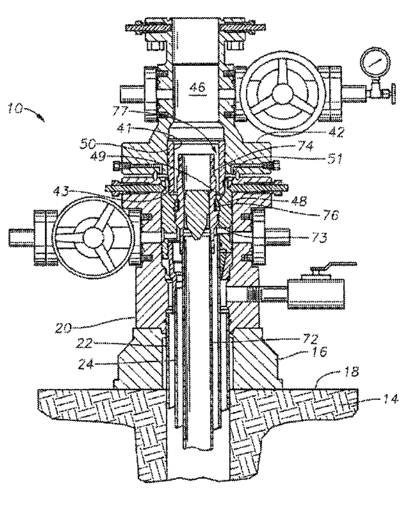
(57) **ABSTRACT**

A wellhead assembly includes a casing head, tubing head, and a production tree mounted on the tubing head. An isolation sleeve is set in a main bore of the wellhead assembly that extends across an interface between the casing and tubing heads so that a portion resides in each. The isolation sleeve is configured so that a fracturing string, and its associated hanger, can be retrieved through the isolation sleeve; which significantly reduces the time and steps required to conduct a fracturing operation in a well. Moreover, the present isolation sleeve can be used without changes to existing casing or tubing heads.

13 Claims, 5 Drawing Sheets



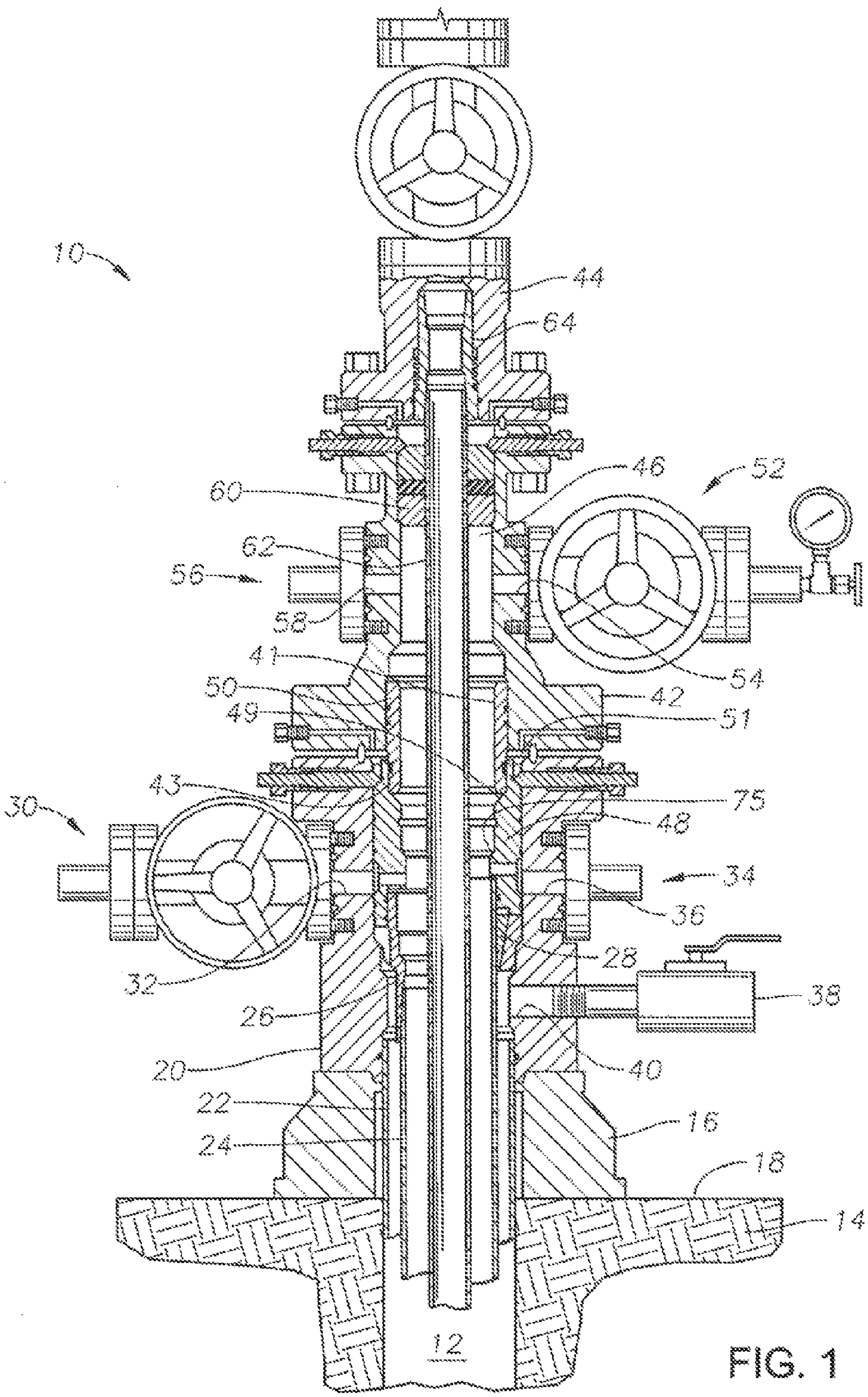

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FIG. 1

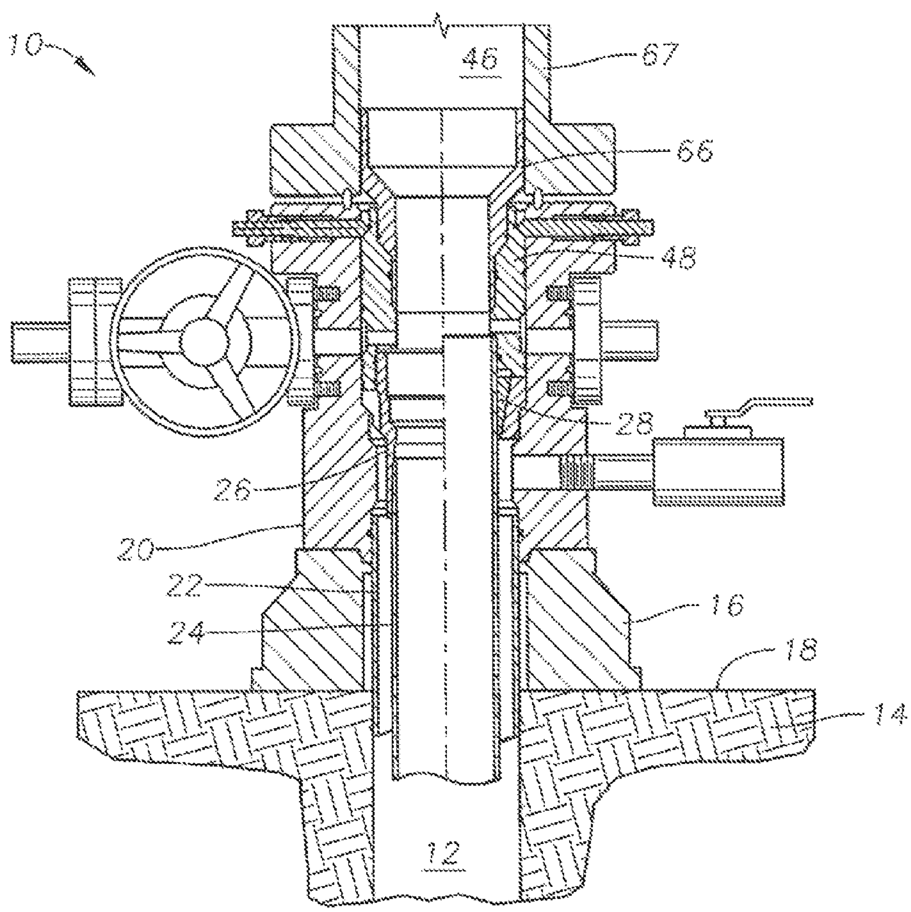

FIG. 2

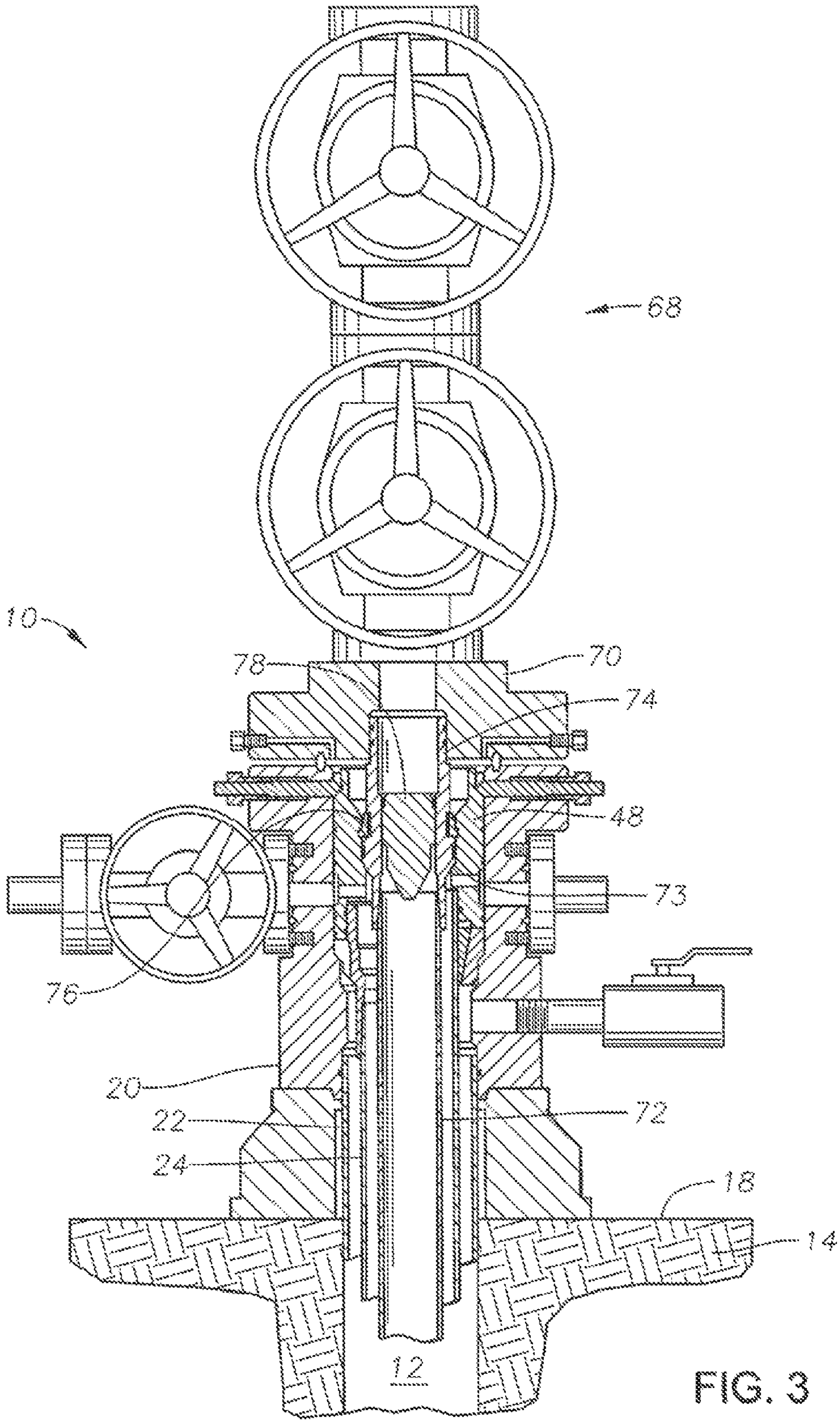

FIG. 3

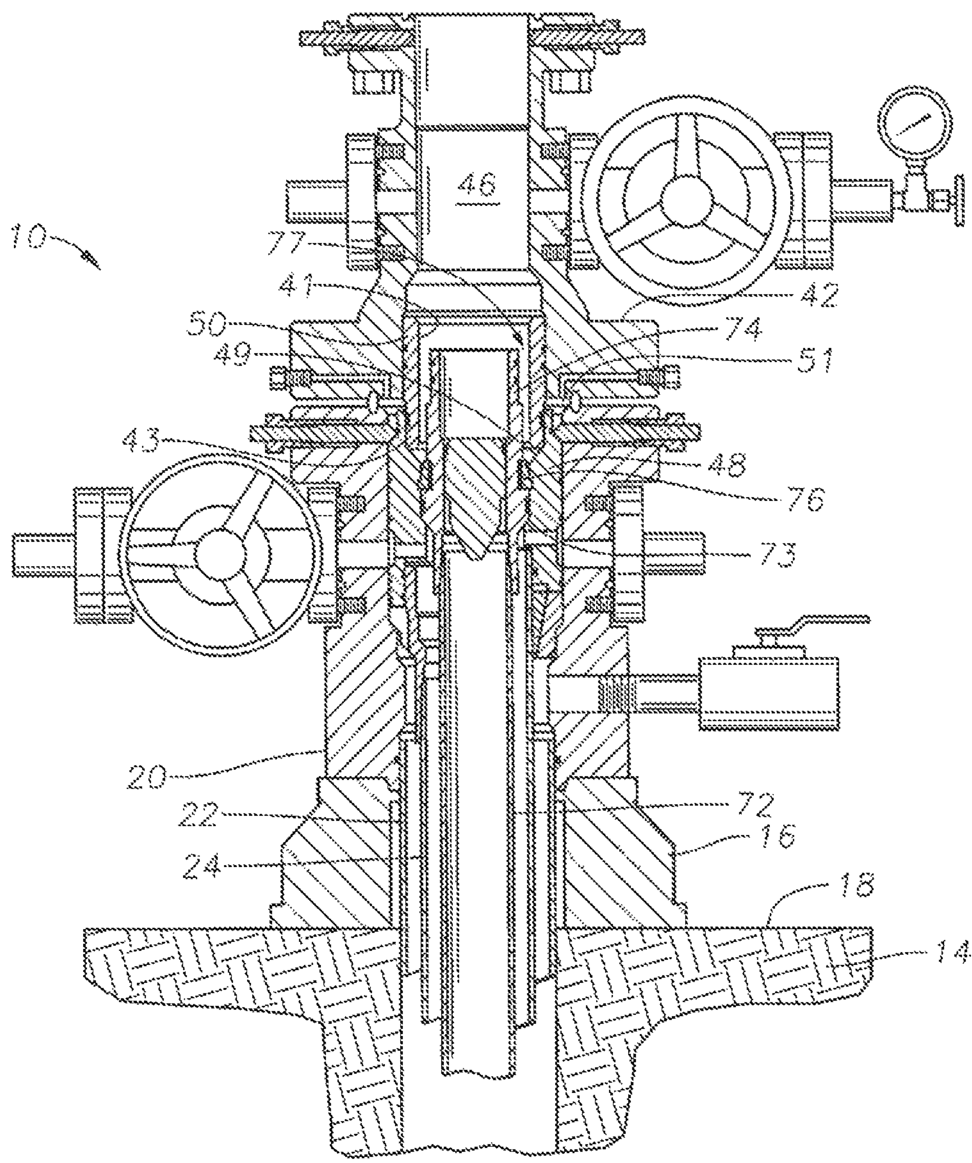

FIG. 4

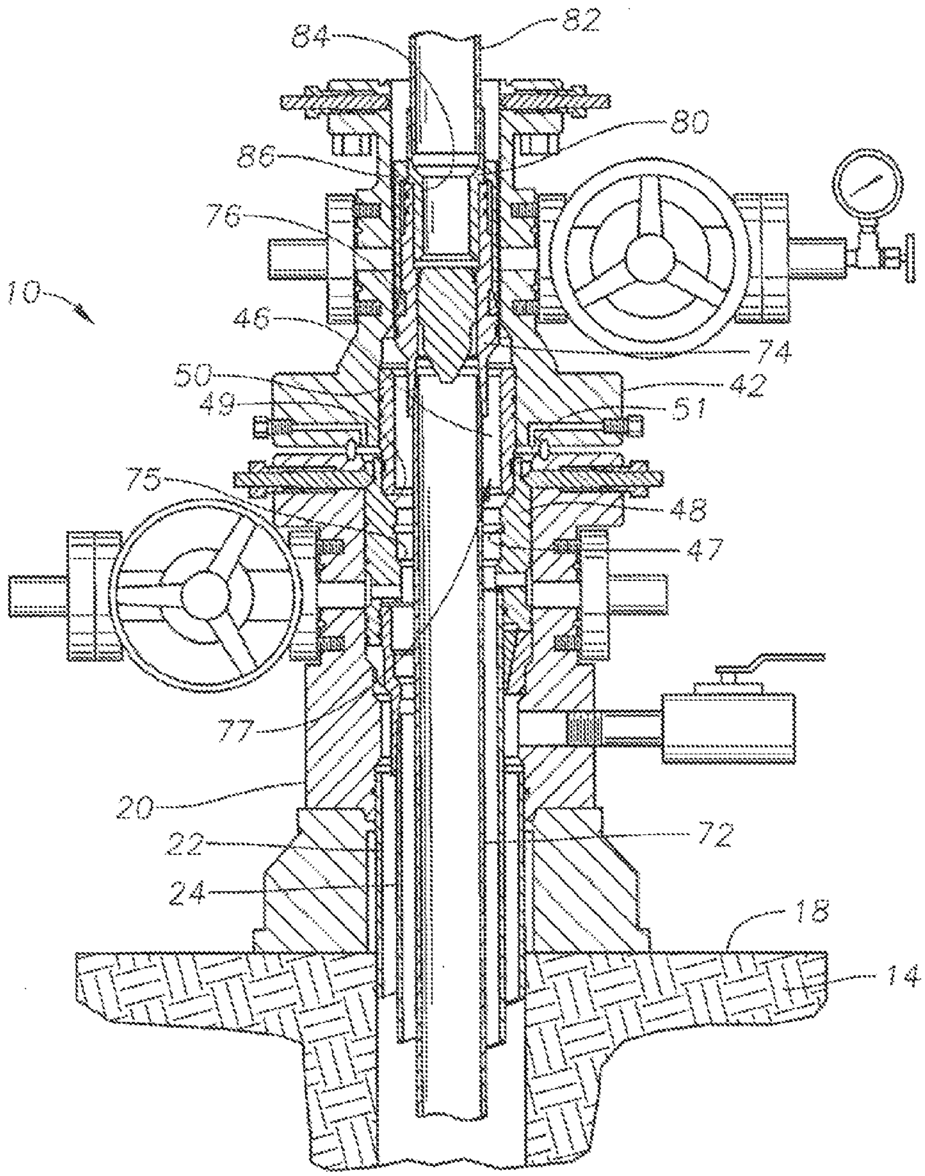

FIG. 5

WELLHEAD SYSTEM FOR TIEBACK RETRIEVAL

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority to and the benefit of co-pending U.S. Provisional Application Ser. No. 61/769,541 filed Feb. 26, 2013 the full disclosure of which is hereby incorporated by reference herein for all purposes.

BACKGROUND

1. Field of Invention

The present disclosure relates in general to a wellhead assembly with an isolation sleeve through which a fracturing string with an associated hanger can be retrieved.

2. Description of Prior Art

Hydrocarbon producing wellbores are sometimes stimulated to increase the production of hydrocarbons. Hydraulic fracturing, or fracing, is one example of stimulation, which involves pressurizing all or a portion of the wellbore to improve communication between the surrounding formation and the wellbore. Generally, a fracturing fluid is pressurized at surface by a pump, which passes through a fracturing tree then enters a fracturing string. The fracturing string extends into the well and is supported by a string hanger in the wellhead. When the fracturing process is completed, a bridge plug is installed in the wellhead and the fracturing tree is replaced with a blowout preventer. A bored out tubing spool is utilized to allow full bore opening. The fracturing string and string hanger are retrieved through the blowout preventer. The blowout preventer and bored out tubing spool can then be removed and replaced with a standard tubing spool and a subsequent wellhead member, such as a tubing head. The bridge plug can be retrieved.

SUMMARY OF THE INVENTION

Embodiments of the system and method of this disclosure eliminate the steps of adding a bridge plug and blowout preventer to the casing head before retrieving the string hanger and fracturing string, as was previously required. The step of having to remove the bridge plug and blowout preventer after retrieving the string hanger and fracturing string are also eliminated. The need for a bored out spool is also eliminated.

Disclosed herein is an example of a wellhead assembly having a casing head mounted on a wellbore and a tubing head on the casing head. A main bore extends axially through the casing head and tubing head. A landing area in the main bore is profiled to selectively receive a fracturing string hanger. An annular isolation sleeve is coaxially set in the main bore. The isolation sleeve has an inner radius greater than an outer radius of the fracturing string hanger, so that the fracturing string hanger selectively passes through the isolation sleeve.

In an alternative embodiment, a wellhead assembly has a casing head mounted on a wellbore and a tubing head on the casing head. A main bore extends axially through the casing head and tubing head. An annular packoff assembly is disposed in the main bore, the annular packoff assembly having a landing area that is profiled to selectively receive a fracturing string hanger. An annular isolation sleeve is coaxially set in the main bore, a first portion of the annular isolation sleeve being located in the tubing head and a second portion of the annular isolation sleeve being located in the casing head. The annular isolation sleeve has an inner radius greater than an outer radius of the fracturing string hanger, so that the fracturing string hanger selectively passes through the isolation sleeve. An inner radius of the main bore of the tubing head is greater than an outer radius of the fracturing string hanger, so that the fracturing string hanger selectively passes through the tubing head.

In yet another alternative embodiment, a method for retrieving a fracturing string hanger from a wellhead assembly includes installing an annular isolation sleeve and tubing head on a casing head of a wellbore, the annular isolation sleeve having an inner radius greater than an outer radius of the fracturing string hanger. The fracturing string hanger is passed through the isolation sleeve.

BRIEF DESCRIPTION OF DRAWINGS

Some of the features and benefits of the present invention having been stated, others will become apparent as the description proceeds when taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a side partial sectional view of an example embodiment of a wellhead assembly set over a wellbore and in accordance with the present invention.

FIG. **2** is a side partial sectional view of a portion of the wellhead assembly of FIG. **1** configured for drilling the wellbore in accordance with the present invention.

FIG. **3** is a side partial sectional view of the wellhead assembly of FIG. **1** with a fracturing tree and fracturing string in accordance with the present invention.

FIG. **4** is a side partial sectional view of an embodiment of the wellhead assembly of FIG. **3**, having a tubing head in place of the fracturing tree and in accordance with the present invention.

FIG. **5** is a side partial sectional view of an embodiment of the wellhead assembly of FIG. **4**, with the fracturing string being removed and in accordance with the present invention.

While the invention will be described in connection with the preferred embodiments, it will be understood that it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alternatives, modifications, and equivalents, as may be included within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF INVENTION

The method and system of the present disclosure will now be described more fully hereinafter with reference to the accompanying drawings in which embodiments are shown. The method and system of the present disclosure may be in many different forms and should not be construed as limited to the illustrated embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey its scope to those skilled in the art. Like numbers refer to like elements throughout.

It is to be further understood that the scope of the present disclosure is not limited to the exact details of construction, operation, exact materials, or embodiments shown and described, as modifications and equivalents will be apparent to one skilled in the art. In the drawings and specification, there have been disclosed illustrative embodiments and, although specific terms are employed, they are used in a generic and descriptive sense only and not for the purpose of limitation.

An example of a wellhead assembly **10** is shown in a side sectional view in FIG. **1**, wherein the wellhead assembly **10** is mounted over a wellbore **12** that projects into a subterranean formation **14**. A base plate **16** (wellhead housing) makes up a lower portion of the wellhead assembly **10**, and sits on the surface **18** of the formation **14**. An annular casing head **20** mounts on top of the base plate **16**; from which a length of conductor casing **22** extends downward into wellbore **12**. Inserted within conductor casing **22** is a string of intermediate casing **24** supported within casing head **20** on a casing hanger **26**, which is shown landed within casing head **20**. Optionally, an emergency casing hanger **28** (casing slip) is shown within casing head **20** and provides an alternative means of securing and supporting the intermediate casing **24**. Valve **30** is shown mounted on a side wall of casing head **20** and provides selective communication between the area ambient to wellhead assembly **10** and the inside of casing head **20** via port **32**. Similarly, a plug assembly **34** provides selective communication to the inside of casing head **20** via port **36**. An additional valve **38** mounts into the side wall of the casing head **20** and communicates with inside of casing head **20** via port **40**.

A flanged coupling sealingly engages an upper end of casing head **20** to an annular tubing head **42**, creating an interface **51** between the upper end of casing head **20** and the annular tubing head **42**. Similarly, a production tree **44** is flange mounted on an upper end of tubing head **42** that is distal from casing head **20**. A main bore **46** axially intersects casing head **20** and tubing head **42**.

An annular packoff assembly **48** is shown coaxially in the portion of main bore **46** that is within casing head **20**. A transition on an inner surface of annular packoff assembly **48** is formed where its inner radius projects outward and defines a circular groove and a landing area or shoulder **49** on its upper end. A lower end of an annular isolation sleeve **50** (isolation bushing) is illustrated mated with and landed on shoulder **49**. In an example, an inner radius of isolation sleeve **50** is at least as large as an inner radius of the annular packoff assembly **48** below shoulder **49**. An inner radius of the main bore **46** of tubing head **42** above isolation sleeve **50** is sized at least as large as an inner radius of the annular packoff assembly **48** below shoulder **49**. The inner radius of the main bore **46** of tubing head **42** is enlarged proximate to the casing head **20** and is as least as large as an outer radius of the isolation sleeve **50** to accommodate the annular isolation sleeve **50**.

In the example of FIG. **1**, isolation sleeve **50** intersects the interface **51** between casing head **20** and tubing head **42** so that opposing portions of isolation sleeve **50** are respectively circumscribed by tubing head **42** and casing head **20** so that a first portion **41** of isolation sleeve **50** is located within tubing head **42** and a second portion **43** of isolation sleeve **50** is located in casing head **20**. Seals on an outer radius of isolation sleeve **50** provide sealing contact between isolation sleeve **50** and annular packoff assembly **48**. Additionally, seals also create a fluid and pressure barrier between the outer radius of isolation sleeve **50** and inner radius of casing head **42**. Thus the isolation sleeve **50** blocks communication between the main bore **46** and fluid lines shown formed through the side walls of casing head **20** and tubing head **42**. Isolation sleeve **50** also seals the main bore **46** from the interface **51** of casing head **20** and tubing head **42**.

Still referring to FIG. **1**, a valve **52** shown registering with port **54** through a side wall of tubing head **42** provides selective communication to main bore **46** from outside wellhead assembly **10**. Additionally, plug assembly **56** which registers with port **58** in a side wall of tubing head **42** allows for selective communication into main bore **46**. Further shown in main bore **46** is a second annular packoff **60** that seals around a string of production tubing **62** shown coaxially within main bore **46** and extending downward into wellbore **12**. In an example, production tubing **62** communicates wellbore fluids produced from within wellbore **12** to the production tree **44**. A production tubing hanger **64** is shown mounted within production tree **44** and supports production string **62**.

The example of the wellhead assembly **10** of FIG. **1** is functional and produces fluids from the wellbore **12**, wherein the wellbore **12** is completed. Referring now to the example of FIG. **2**, the wellbore **12** is shown in a stage of being formed and prior to being completed. The wellhead assembly **10** of FIG. **2** includes an annular wear bushing **66** coaxially mounted within main bore **46** and landed on the annular packoff assembly **48**. In this example, wear bushing **66** protects annular packoff assembly **48** from a drill string (not shown), that inserts through the main bore **46** and bores through the formation **14** to form the wellbore **12**. A blowout preventer **67**, which is shown coupled on an upper end of casing head **20** with a flange connection, can be used for pressure control of the wellbore **12**. Further in the example of FIG. **2**, an upper end of the wear bushing **66** is coaxially disposed within a portion of the main bore **46** in the blowout preventer **67**, while its lower end is circumscribed by the annular packoff assembly **48**, which is within casing head **20**.

FIG. **3** illustrates in a side partial sectional view an example of fracturing the formation **14** adjacent the wellbore **12**. As shown, the blowout preventer **67** has been removed and replaced with a fracturing tree **68** coupled with the casing head **20**. An optional tubing head adapter **70** attached to a lower end of fracturing tree **68** mounts onto casing head **20** with a flange connection, thus facilitating connectivity of fracturing tree **68** with casing head **20**. Instead of production tubing **62** (FIG. **1**), a tieback or tubular fracturing string **72** extends into wellbore **12** from fracturing tree **68** and through casing head **20**. Supporting the fracturing string **72** is a string hanger **74** shown having an upper end coupled coaxially within tubing head adapter **70**. In this example, the wear bushing **66** (FIG. **2**) has been removed from within the annular packoff assembly **48** which allows a lock ring **76** of the string hanger **74** to selectively engage an inner profile **47** (FIG. **5**) of the annular packoff assembly **48**. An inner radius of the annular packoff assembly **48** is reduced at its lower end to form an upward facing or landing area or circular shelf **75** (FIG. **5**). A sloped downward facing surface **73** of string hanger **74** engages circular shelf **75**. In alternative embodiments, lock ring **76** may be omitted. An external radius of string hanger **74** is sized to fit within a portion of annular packoff assembly **48**. Fracturing string **72** delivers fracturing fluids into the wellbore **12**, which fracturing tree **68** controls a flow of the fracturing fluid to the fracturing string **72**.

Referring back to FIG. **3**, after fracturing operations are complete, a back pressure valve **78** can be inserted within fracturing string **72** thereby blocking communication from within wellbore **12** into above the back pressure valve **78**. In this case, the back pressure valve **78**, string hanger **74**, and annular packoff assembly **48** are shown coaxially disposed within casing head **20**. Isolating pressure within the wellbore **12** with the back pressure valve **78** allows removal of tubing head adapter **70** and fracturing tree **68**.

As shown in FIG. **4**, tubing head adapter **70** and fracturing tree **68** (FIG. **3**) have been removed from the wellhead assembly **10**. Instead of installing a bridge plug to casing head **20** and adding a blowout preventer to the upper end of casing head **20**, embodiments of this disclosure allow for tubing head **42** and isolation sleeve **50** to now be installed on the upper end of casing head **20**. Further in this example, the inner radius of isolation sleeve **50** exceeds the outer radius of the string hanger **74** and forms an annular gap **77** between these two members. This gap **77** allows for the required clearance for string hanger **74** and fracturing string **72** to be pulled out of casing head **20** and pass through tubing head **42**. Because the inner radius of the isolation sleeve **50** and tubing head **42** above isolation sleeve **50** is at least as large as an inner radius of the annular packoff assembly **48** below shoulder **49**, string hanger **74** and fracturing string **72** can pass through isolation sleeve **50** and tubing head **42**. Thus string hanger **74** and fracturing string **72** can be retrieved from within wellhead assembly **10** without removing tubing head **42**.

The example of FIG. **5** illustrates in partial side sectional view an example of removing the string hanger **74** from within the wellhead assembly **10** using a landing joint **80** that is coupled to a lower end of a pipe string **82** with a threaded connection. The landing joint **80** is an annular member with an inner sleeve **84** Inner sleeve **84** inserts within an upper end of string hanger **74** and engages threads formed on an inner radial surface of string hanger **74**, allowing landing joint **80** and pipe string **82** to retrieve string hanger **74** and fracturing string **72** from within wellhead assembly **10**. In certain embodiments, landing joint **80** has an outer sleeve **86**. A lower end of outer sleeve **86** extends over lock ring **76** to disengage lock ring **76** from profile **47** and maintain lock ring **76** in a position that prevents lock ring **76** from moving radially outward as string hanger **74** is removed.

Because the inner radius of the isolation sleeve **50** and the inner radius of the main bore **46** are at least as large as the inner radius of the annular packoff assembly **48**, there is sufficient space within the isolation sleeve **50** and tubing head **42** to retrieve the string hanger **74** through tubing head **42**. Moreover, the strategically dimensioned isolation sleeve **50** eliminates the steps of adding a bridge plug and blowout preventer before retrieving the string hanger **74** and fracturing string **72** then removing the bridge plug and blowout preventer after retrieving the string hanger **74** and fracturing string **72**, as was previously required.

The present invention described herein, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned, as well as others inherent therein. While a presently preferred embodiment of the invention has been given for purposes of disclosure, numerous changes exist in the details of procedures for accomplishing the desired results. These and other similar modifications will readily suggest themselves to those skilled in the art, and are intended to be encompassed within the spirit of the present invention disclosed herein and the scope of the appended claims.

What is claimed is:

1. A wellhead assembly comprising:

a casing head mounted on a wellbore;

a tubing head on the casing head;

a main bore extending axially through the casing head and the tubing head;

a landing area in the main bore that is profiled to selectively receive a fracturing string hanger; and

an annular isolation sleeve coaxially set in the main bore and having an inner radius greater than an outer radius of the fracturing string hanger, so that the fracturing string hanger selectively passes through the isolation sleeve, wherein the isolation sleeve extends across an interface between the casing head and the tubing head.

2. The wellhead assembly of claim **1**, further comprising an annular packoff assembly disposed in the main bore.

3. The wellhead assembly of claim **2**, wherein the landing area is along an inner radius of the annular packoff assembly.

4. The wellhead assembly of claim **1**, further comprising an annular packoff assembly disposed in the main bore, the annular packoff assembly having: the landing area that is profiled to selectively receive the fracturing string hanger; and a shoulder for mating with the isolation sleeve.

5. The wellhead assembly of claim **1**, wherein an inner radius the main bore of the tubing head proximate to the casing head is enlarged to accommodate the isolation sleeve.

6. A wellhead assembly comprising:

a casing head mounted on a wellbore;

a tubing head on the casing head;

a main bore extending axially through the casing head and the tubing head;

an annular packoff assembly disposed in the main bore, the annular packoff assembly having a landing area that is profiled to selectively receive a fracturing string hanger;

an annular isolation sleeve coaxially set in the main bore, a first portion of the isolation sleeve being located in the tubing head and a second portion of the isolation sleeve being located in the casing head, the isolation sleeve having an inner radius greater than an outer radius of the fracturing string hanger, so that the fracturing string hanger selectively passes through the isolation sleeve; and wherein

an inner radius of the main bore of the tubing head is greater than an outer radius of the fracturing string hanger, so that the fracturing string hanger selectively passes through the tubing head.

7. The wellhead assembly of claim **6**, wherein the annular packoff assembly further comprises a shoulder for mating with the isolation sleeve.

8. The wellhead assembly of claim **6**, wherein an inner radius of the main bore of the tubing head is at least as large as an inner radius of the annular packoff assembly.

9. The wellhead assembly of claim **6**, wherein the annular packoff assembly further comprises an inner profile for selective engagement with a lock ring of the fracturing string hanger.

10. A method for retrieving a fracturing string hanger from a wellhead assembly, comprising:

(a) installing an annular isolation sleeve and a tubing head on a casing head of a wellbore, the isolation sleeve having an inner radius greater than an outer radius of the fracturing string hanger, and wherein an inner radius of a main bore of the tubing head is greater than an outer radius of the fracturing string hanger;

(b) passing the fracturing string hanger through the isolation sleeve; and

(c) retrieving the fracturing string hanger through the tubing head.

11. The method of claim **10**, wherein step (a) comprises installing a first portion of the isolation sleeve in the tubing head and installing a second portion of the isolation sleeve in the casing head.

12. The method of claim **10**, further comprising before step (a) installing an annular packoff assembly in the casing head, the annular packoff assembly having a landing area that is profiled to selectively receive the fracturing string hanger.

13. The method of claim **12**, wherein installing the isolation sleeve on the casing head comprises landing the isolation sleeve on the annular packoff assembly.

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